

north of the Caledonian Canal, it seems to me that this is extremely improbable, as along the two traverses we made—one from Garve to Ullapool, the other from Laxford to Lairg—the prevalent dips are eastward, and the upper quartzites forming the elevations of Ben Dearig and Ben More are of great thickness. One may therefore assume that the Laurentian gneiss (even in the absence of the Cambrian sandstone) is deeply buried beneath these beds and their succeeding schists. The region of the Grampians of Aberdeenshire, on the other hand, is of great extent, and until it has been explored by the officers of the Geological Survey it would be injudicious (as it appears to me) to come to any opinion on the subject.

EDWARD HULL
Geological Survey Office, Hume Street, Dublin, January 18

Geological Climates

HAVING considered the effects of Mr. Wallace's proposed redistribution of land and water, intended to raise the mean annual temperature of Bournemouth 15° or 20° F. above its present amount, I now, with your permission, shall say a few words on some minor questions, which have arisen during our discussion of the difficult problem of Geological Climates.

1. *The Clump of Bamboos at Cooper's Hill Engineering College.*—Prof. McLeod has kindly forwarded me a specimen of the foliage of the bamboo now growing in his garden, and has promised to send me the fruit when it ripens.

My botanical friends cannot decide its species, with certainty, from the foliage alone, without the seeds, but think that it, probably, is the bamboo called *Thamnochalamus Falconeri*, formerly called *Arundinaria falcata* (not *Arundinaceae*) and also called *Bambusa gracilis*. If this opinion be correct my rejection of its evidence in favour of Cooper's Hill now having the climate of "torrid India" was also correct; for this bamboo is one of the hardiest of the "hardy bamboos" growing in the Himalayas, as high as the limit of perpetual snow, and being exposed, at night and in winter, to extremes of cold, which are never experienced in the British Islands. Whether our summers are hot enough to ripen its seeds, and fully acclimatise it amongst us, remains to be seen.

It is a suggestive fact that at Fota, in the Cove of Cork, where it grows in clumps 20 feet in circumference, from each of which spring over 400 canes, reaching a height of 25 feet; the seeds ripen with difficulty and take a long time to germinate, some two months elapsing before they come through the soil, even in a temperature of 70° F.

2. *The Moreton Bay Pine at Bournemouth.*—Mr. William Ingram's letter, stating that an individual of this species, surrounded with "wooded heights" about it, has lived for forty years in Leicestershire, and attained a height of 35 feet, shows what the gardener's skill can accomplish in protecting a sub-tropical tree from the injurious effects of English winters, but throws no light whatever upon the possibility of the Moreton Bay pine living spontaneously in this country.

In order to do so it must ripen its fruit and produce seedlings, which (as I am informed) it cannot possibly do with the moderate heat of our cool summers.

3. *Tertiary Climates in England.*—Mr. Gardner states, that independently of the evidence afforded by the Moreton Bay pine, the Tertiary fossil plants of the Eocene require an increase of temperature of, at most, 20° F.

When we add to this that the London clay contains true *Crocodiles*, true *Palms*, many species of *Nauvius*, of *Volutes*, and large species of *Cyprea*, we may be certain that 20° F. increase of temperature is the very minimum required.

The question of importance is, whence did this required heat come from? This is a question of number and magnitude, and not of mere "naturalist talk." This question cannot be settled by redistributions of land and water, nor by repeating continually the assertion that all former causes of change of climate were the same as existing causes, not only in kind, but in degree.

SAMUEL HAUGHTON

Trinity College, Dublin, January 14

I AGREE with Prof. Haughton in his conclusion that no increase in the quantity of water sent into the Arctic Ocean by currents like the Gulf Stream would make much practical difference in the Arctic climate, though not altogether for his reasons. I think the question of total quantities of heat is irrelevant, and that the extent of glaciation and the distribution

of plants and animals are almost exclusively determined by summer temperatures.

Respecting the distribution of plants and animals, I believe this is the general testimony of naturalists, and it is certainly confirmed by Nordenstjöld's observations on the Siberian flora. Respecting glaciation, I rely for proof on the well-known fact that the extent of perpetual snow on mountains—in other words, the height of the snow-line—depends, not on mean temperature, but on summer temperature.

If this is true it shows that no change in the ocean currents would make much difference; for a glance at Dove's isothermal lines for July and January shows that the effect of the Gulf Stream on the temperatures of Europe and Asia and the Arctic Ocean is chiefly confined to winter. The late Mr. Hopkins, in his well-known paper on changes of climate (Geological Society, December, 1851) estimated that the effect of the Gulf Stream on the July climate of London is null.

JOSEPH JOHN MURPHY

Old Forge, Dunmurry, Co. Antrim, January 17

Prof. Whitney on the Glaciation of British Columbia

It must be gratifying to all geologists interested in the western part of America to find that a portion of the general results of the work of the Californian Survey is at length being published under the auspices of the Museum of Comparative Zoology at Harvard College, Prof. Whitney's "Auriferous Gravels of the Sierra Nevada" being now supplemented by the first part of a volume on the "Climatic Changes of Later Geological Times," dealing chiefly with the evidences of glaciation on the Pacific slope. No one will question Prof. Whitney's observations and deductions on this subject when he deals with that portion of the region with which he is personally familiar, especially as these are in substantial agreement with the already-published facts of Clarence King. The general result arrived at in the areas of Whitney's and King's surveys is that comparatively only a very small portion of the highest ranges of mountains has ever been covered with glaciers, and that there has never been in this region anything like a northern drift period or a transportation of material in any given direction independent of the present topographical features of the country.

This accords also with the statement published by Prof. Whitney in 1866 (*Proc. Col. Acad. Sci.* vol. iii. p. 271) as to the absence of glacial traces of a general character from California, but—as it appears to me unfortunately—a clause was added to this statement embracing in the generalisation the whole north-western extension of the Cordillera region. Now in 1866, as Prof. Whitney himself says, almost nothing was definitely known of the coast north of Oregon, and for that portion of it included in the province of British Columbia I have since maintained, as the results of observation, that there is conclusive proof of the occurrence of a period of general glaciation comparable in its effects with that of eastern North America (see *Quart. Journ. Geol. Soc.* vol. xxxiv. p. 89; *Canadian Naturalist*, vol. viii. No. 7; vol. ix. No. 1; also the following *Reports of the Geological Survey of Canada*, 1875-76, p. 261; 1877-78, p. 133 B.; 1878-79, p. 89 B.) In summarising and discussing the evidences of glaciation in British Columbia however Prof. Whitney still thinks it necessary to support the correctness of his paper of 1866. As Prof. Whitney's volume appears to be intended as a general, and, so far as the facts now known go, final review of the glaciation of the Pacific slope, and professes to contain "all that is necessary to set forth in regard to the former glaciation of the western side of the American continent," it may not be amiss to state that in my view the account given of the evidences of glaciation in British Columbia is in some cases insufficient, and that in the interpretation of other points misconceptions as to the nature of the facts have arisen. The tendency of the whole treatment of the subject is to minimise the glacial phenomena of the northern part of the coast and assimilate the conditions there found to those of California, which appear to me to be essentially different. (For a comparison of these see "Travelling Notes on the Surface Geology of the West Coast," *Canadian Naturalist*, vol. viii. No. 7.)

To criticise minutely the numerous features which seem open to such treatment in the account of this region, with which seven seasons' work in connection with the Boundary Commission and Geological Survey of Canada has rendered me familiar, would require a lengthened article, and would at best be an ungracious task. I will therefore touch on a few salient points only.

In dealing with the interior region of British Columbia lying between the Rocky and Coast Mountains no mention is made of the actual evidence obtained of a movement of ice from north to south in this plateau district, though it is afterwards incidentally alluded to in a quotation connected with a proposed explanation of the facts observed. The drift-covered and erratic-strewn character of the country is also ignored; and while the lower terraces bordering the rivers are mentioned, and attributed to fluvia-tile action—a view doubtless substantially correct—the fact that terraces are found beyond the river-valleys attaching themselves to the higher parts of the plateau and to the mountain-sides to an elevation of 5270 feet is passed over in silence. The conclusion is then easily arrived at that the "statement" of 1866 is "entirely borne out by an overwhelming weight of evidence."

Turning now to the coast of the province, Prof. Whitney of course admits the marked glaciation of the south-eastern extremity of Vancouver Island, which has been noticed by a number of observers, and which he has himself seen during a hurried visit. He states however that the markings he saw were everywhere parallel to the coast, and appeared to him more like iceberg than glacier work. Now as the coast is very sinuous in outline, while the main glaciation pursues *within a few degrees a uniform direction* (S. 11° W.), the two must in some places coincide, but an intimate acquaintance with the south-eastern part of Vancouver Island enables me to state that the glaciating agent has swept completely and steadily over it entirely, without reference to the present coast outlines. With regard to the second statement, I believe that a reference to the description of the character of the glaciation given in one of my papers already referred to (*Quart. Journ. Geol. Soc.*, vol. xxxiv, p. 92) will be sufficient to convince any one who is familiar with ice action that a glacier has done the work. It is of course easier to be personally assured, where so much depends on judgment of local details, than to demonstrate the actual conditions to others; but the parallel grooving and furrowing out of hard rocks in the manner illustrated on pp. 93, 94, and 96, one has been accustomed to consider as characteristic of glaciers.

Further on Prof. Whitney assumes that the "manifestations" of the supposed Strait of Georgia glacier are "almost or quite exclusively limited to its termination." Some evidence to the contrary is however given in the publication to which special reference has just been made, while subsequent exploration—the published account of which Prof. Whitney appears to have overlooked—has brought to light similar and concordant glacier-work at Nanaimo, ninety miles to the north-west of Victoria, and has also demonstrated that a second branch of the great ice mass which choked the space between Vancouver Island and the mainland, comparable in size with that of the Strait of Georgia, discharged north-westward by Queen Charlotte's Sound (*Canadian Naturalist*, vol. ix. No. 1). In the lately-issued volume of the Geological Survey (1878-79) additional facts tending to show the importance of ice-action in the Queen Charlotte Islands and extreme north of the coast of British Columbia are given.

Not being in the position of having any favourite theory of glaciation to maintain, I wish merely to indicate by a few examples the inadequacy of the portion of Prof. Whitney's monograph which is intended to summarise the glacial conditions of British Columbia. Prof. Whitney appears to have been beset by observers "entirely inexperienced in the study of glacial phenomena" to such an extent as to render him unduly suspicious of the evidence obtained by other workers. He states, for example, that in passing to the region north of the boundary of the United States "we have to depend largely on the observations of others," and that "an attempt will be made to sift the evidence offered." Now while it is a little disconcerting to find that one must belong to the class of "others," I feel confident that to any unprejudiced inquirer the facts already accumulated and published are sufficient to prove the general and pronounced character of the glaciation of British Columbia. It is perhaps not too much to ask that in this matter purely negative shall not be put on an equality with positive evidence. Prof. Whitney's profound distrust of the "others" again appears where he qualifies a reference to my statements by the clause "even if his observations be accepted as entirely trustworthy." It is, however, so far satisfactory to find oneself in good company, for Dr. Hector, who has also had the misfortune to have had something to say about this region which does not conform to Prof. Whitney's hypotheses, is referred to as "evidently quite inexperienced," and one whose "statements must be received with some caution," while Dr. R. Brown for a

similar sin is characterised as "an entirely unpractised observer."

GEORGE M. DAWSON

Geological Survey of Canada, Montreal, December 22, 1880

Lophiomys Imhausi

IN NATURE of January 1, 1880, I published a note on the "habitat" of that strange and excessively rare rodent *Lophiomys Imhausi*; it may interest many of your readers to know that I have recently received from Count Lodovico Marazzani a splendid specimen of that species from a new locality, viz. Erkauid, on the mountains between Suakin and Singat, where it was captured quite accidentally on April 12 last by a shot from a small revolver. It was also secured and preserved by mere chance, for it was found by a small terrier and killed at the bottom of a deep fissure in the granitic rocks, and its value was quite ignored by those who first handled it; thus the skeleton and viscera were lost, but happily the skin was in excellent condition, and the skull had been left attached. It is an adult female and has four teats, two pectoral or rather axillary, and two inguinal; it is rather larger than the fine specimen at Genoa, but does not differ in colour or richness of fur. The luxuriant dorsal mane to which this creature owes its name is separated from the long hairs of the body by a narrow stripe of short stiff greyish green bristles. The iris was dark brown, and the animal emanated no special odour.

This is the fourth specimen of *Lophiomys Imhausi* that has been secured to science; the first was the type specimen accidentally brought alive by M. Imhaus at Aden and described by Prof. A. Milne-Edwards: it is in the Paris Museum, skin, skeleton, and viscera preserved. The second is the skull accidentally picked up by Dr. Schweinfurth at Maman, north of Kassala, and described in 1867 by Prof. Peters as *Phractomys ethiopicus*; it is I believe at Berlin. The third was accidentally killed by a blow on the head with a stick in the Seriba of Beccari and Antinori at Keren in the Bogos country in 1870; the mounted skin and skeleton are in the Civic Museum at Genoa. The fourth is the subject of this note; its skin has been splendidly mounted by my able taxidermist Signor R. Magnelli, and it and the cranium form an important item of the Florence Zoological Museum. The natives told Count Marazzani that *Lophiomys* is rare, that it lives in deep holes in the strangely fissured rocks of that country, and that it is a vegetable feeder; the stomach of the specimen I have was much distended with leaves and young shoots when Count Marazzani skinned it.

The "habitat" of this species is now pretty well defined by lines drawn from Suakin to Maman and Kassala, and thence southward towards the Somali coast.

HENRY HILLYER GIGLIOLI

Reale Istituto, Florence

Parhelion

YESTERDAY a parhelion or mock sun was seen here. At 3h. 20m. I was at the Observatory, and the true sun was sinking in the south-west upon a somewhat dense cloud-bank with light and long cirro strati about and above it. The air was comparatively calm, the anemometer cups moving only occasionally and slowly. The horizon was foggy and misty. The spectral sun appeared as a bright diffused circular spot of light tinged with prismatic colours about 30° to the left (E.) of the true sun, and in a horizontal line with it.

I could trace a segment of a circle having the sun for its centre, for a few degrees above and below the mock image.

To the west I could not trace any false image or continuation of the circle. The phantom image slowly faded away in about ten minutes from its being first observed. The weather has been severe here (something over 200 feet above sea), but hardly so sharp as in some other (probably lower-lying) places. With Negretti and Zambra's standard minimum in cage four feet from the ground, 11° is the lowest I have registered.

During, however, the past seven days the maximum has only twice risen above freezing-point, and then but 1°.

Guildford, Guildford, January 21

J. RAND CAPRON

Girton and Newnham Colleges

SOME of your readers may perhaps be glad to help the natural science students of Girton and Newnham Colleges to raise about 800*£*, needed for a physical and biological laboratory. The